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WHAT IS CLAIMED IS:

- membrane structure comprising a silicon film having a 1
- grain structure including grains defining pores therebetween. 2

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- A membrane structure comprising a silicon film including 4 2.
- grains having gaps formed therebetween to define individual 5
- pores, the maximum cross-sectional dimension of any one grain 6
- 7 approximately equal to the thickness of the film.

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- The structure of claim 2 wherein a lateral dimension of 9
- ___10 any pore is less than that of any grain.

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- 12 13 14 The structure of claim 2 wherein a lateral dimension of
 - the pores is between about 10 and 50 nanometers.

- The structure of claim 2 wherein the thickness of the
- **1**6 film is less than or equal to about 150 nanometers.

TU 17

- 18 The structure of claim 2 wherein the thickness of the
- 19 film is between about 50 and 150 nanometers.

20

- The structure of claim 2 wherein the roughness of the 21 7.
- 22 film is approximately equal to its thickness.

23

8. The structure of claim 2 wherein the film forms a filter. 24

25

- 9. The structure of claim 2 wherein the film is conformal to 26
- 27 an underlying surface.

28

29	10.	The	structure	e of	claim	2	further	including	a	structural
30	layer	c to	support t	the	film.					

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- 32 11. The structure of claim 2 further including a conformal
- layer formed on the film to provide a selected chemical or
- 34 biological function.

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- 36 12. A membrane filter structure comprising a silicon film
- 37 having a grain structure including grains defining pores
- therebetween, a lateral dimension of the pores being between
- 39 about 10 and 50 nanometers and the maximum diameter of any one
- 40 grain not exceeding the thickness of the film.

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- 13. A method of fabricating a membrane structure comprising: forming a sacrificial layer over a first surface of a
- forming a substrate;

 forming a substrate;

 forming a
 - forming a silicon layer over the sacrificial layer such
- that the silicon layer has a grain structure including
- 47 grains defining pores therebetween wherein the maximum
 - 48 diameter of any one grain does not exceed the thickness
- of the membrane structure; and
 - 50 removing the sacrificial layer.

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- 52 14. The method of claim 13 further including forming a
- passageway through the substrate.

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- 55 15. The method of claim 13 further including forming a
- 56 conformal layer over the silicon layer to provide a selected
- 57 chemical or biological function.

58

59 16. A method of fabricating a membrane structure comprising:

07043-103001 / B01-106

60		forming a sacrificial layer over a surface of a						
61		substrate;						
62		forming a structural layer over the sacrificial layer;						
63		forming a silicon layer over the structural layer such						
64		that the silicon layer has a grain structure including						
65		grains defining pores therebetween wherein the maximum						
66		diameter of any one grain does not exceed the thickness						
67		of the membrane structure; and						
68		removing the sacrificial layer.						
69								
70	17.	A method of fabricating a membrane filter structure						
71	comp	orising:						
= 72		forming a sacrificial layer over a first surface of a						
□ 73		substrate;						
73 73 42 74 4 75		growing a silicon film over the sacrificial layer at a						
75		temperature near the tensile-to-compressive transition						
7 6		temperature of the silicon film such that the silicon						
₹ 77 -å		film has a grain structure including grains defining						
4 78		pores therebetween wherein the maximum diameter of any						
79		one grain does not exceed the thickness of the membrane						
80		filter structure; and						
Services Services								

81 82

The method of claim 17 wherein the silicon film is 83 formed under a near zero-stress condition. 84

removing the sacrificial layer

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The method of claim 17 wherein the silicon film has a 86 residual stress within a range of about -50 to 50 mega-87 Pascals. 88

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- 07043-103001 / B01-106 The method of claim 17 wherein the silicon film has a 90 residual stress within a range of about -100 to 100 mega-91 Pascals. 92 93 The method of claim 17 wherein the silicon film is grown 94 such that a lateral dimension of any pore is less than that of 95 any grain. 96 97 The method of claim 17 wherein the silicon film is grown 98 such that a lateral dimension of the pores is between about 10 99 and 50 nanometers. 100 101 102 The method of claim 17 wherein the silicon film is grown 23. such that the thickness of the film is between about 50 and 104 105 106 150 nanometers.
- The method of claim 17 wherein the silicon film is grown 24. ≅ 107 such that the roughness of the film is approximately equal to **108** its thickness.
- <u>_</u>110 The method of claim 17 further including forming a 25. 111 conformal layer on the silicon film to provide a selected chemical or biological function. 112

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- The method of claim 17 further including monitoring the 114 residual stress of the silicon film. 115
- 116 117 118 119 120